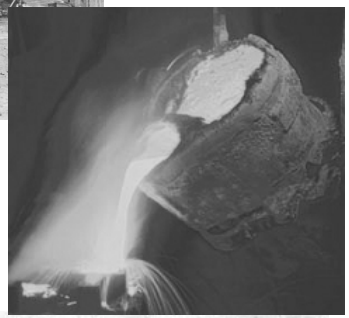
Update on NIST Bioscience/Health Program and Planning Activities

Willie E. May
August 2007 VCAT Meeting

Outline from March 2007 Presentation

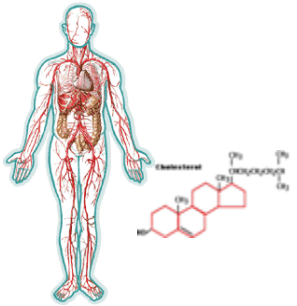
- Brief History of Healthcare Standards Program
- Formal NIST Commitment to the Emerging Biotechnology Industry
  - *Formation of Biotechnology Division*
- Expansion of Bio Activities throughout NIST in the late 1990's and 2000's
- Development of NIST-Wide Strategic Vision for Bio and Health Activities

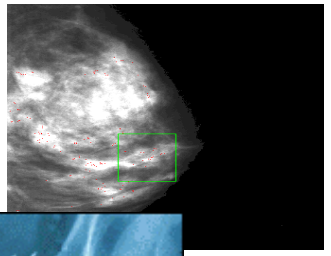
Since its inception NIST has focused its research and measurement standards program on addressing contemporary societal needs.

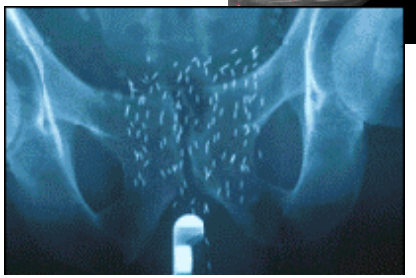


1901

2007







Examples of Healthcare Activities

1928 - Today: NIST & the American Dental Association

- Led to the development of mercury-free amalgams and the air-driven turbine drill now found in virtually all dentist offices

1920s - Today: NIST and Radiation Physics

- Critical program in dosimetry initially involving X-ray calibration and now standards for mammography and brachytherapy
- Radionuclide standardization for radiopharmaceuticals

1970's - Today: Standards for Clinical Diagnostics

- Primary references for electrolytes and metabolites
- Serum based standards for electrolytes and metabolites
- New protein, peptide or DNA-based biomarkers

Biotechnology Division Established

At the request of US Senate, NIST prepared a plan for development of a measurements and standards program to support the emerging Biotech Industry.

In 1991, the **Biotechnology Division was created** as a part of a NIST-wide reorganization.

- **Scientists with "bio-related expertise" from seven divisions** were brought together to assess needs and begin developing the generic measurements, models, data and standards needed to accelerate the commercialization of biotechnology

Efforts focused on:

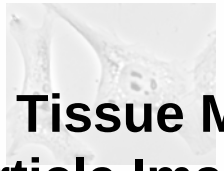
- **Bioanalytical Separations**
- **Sensor Technologies**
- **Biophysical Chemistry**
- **Structural Biology**
- **Bioprocess Engineering**

Bio-Related Activities Have Expanded and Morphed … Within CSTL

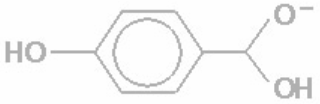
DNA and RNA Science
Metrology for Gene Expression
Nanobiotechnology

Marine Bioscience and Health
Metrology for Drug Delivery Systems
Standards for Food Safety and Nutrition

Cell and Tissue Measurements
Nanoparticle Imaging in Tissue
Quantitative Cell Biology

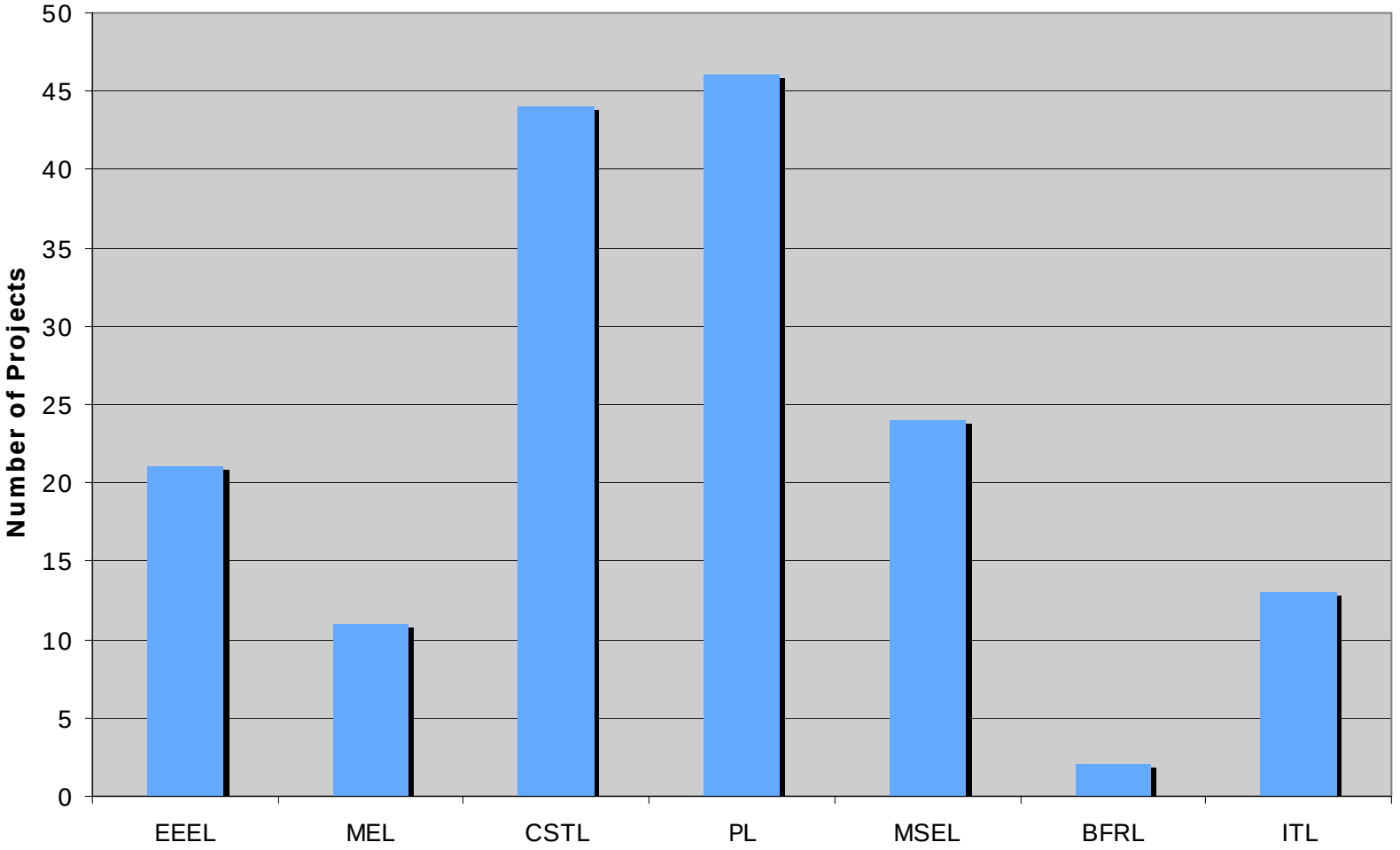


Structural Biology
Standards for Clinical Proteomics



Standards for Metabolomics

…and Throughout NIST



Total Funding estimated to be ~$45M. Of over 160 projects/programs; only 26 have > $500K funding; only 5 projects > $1M

How should we prioritize and focus our activities?

Input from VCAT

Consider radical changes to how it (NIST) supports the biotechnology and health care industries

Dr Thomas M. Baer, Executive Director, Stanford Photonics Research Center, Stanford University - NIST VCAT Meeting, June, 2006

Provide measurements and standards to support next-generation clinical diagnostics

- Technologies for detection organ-specific proteins in blood – e.g., global proteomics, microfluidics and nanotechnology measurement technologies
- Single cell analyses
- Technologies for the capture, storage, analysis, integration, and modeling of global data sets

Dr Leroy Hood, President, Institute for Systems Biology - NIST VCAT Meeting, September, 2006

“Biovision Team” Established in FY07

Charged with:

- Establishing a statement that clearly articulates NIST’s role in Bio and Health
- Developing resource allocation plan for FY07 Bioimaging Initiative
- Identifying high priority areas for program expansion and/or redirection
- Overseeing coherent development on new initiatives to support the program expansion

Outline for This August 2007 Presentation

- NIST Role in Biosciences and Health
- Summary of our Current Investments and Activities
- Update on NIST Bioscience and Health Program Implementation Plans
- Future Plans for Program Expansion

NIST Mission

To promote U.S. **innovation** and industrial **competitiveness** by advancing **measurement science, standards, and technology** in ways that enhance *economic security* and improve our *quality of life.*

NIST Role in the Biosciences

To leverage our vast expertise in the **quantitative physical and informational sciences** to provide the measurement infrastructure to underpin increased **innovation in the biosciences.**

NIST Role in the Biosciences

We do this by

- *Maintaining World-Class research programs and facilities for the physical, chemical and informational sciences*
- *Recruiting staff with expertise and interest in working as part of interdisciplinary teams*
- *Establishing new and strengthening existing external partnerships that complement our facilities and expertise*
- *Working with stakeholders in the government, academic and private sectors to identify and address measurement and information barriers to innovation*

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FY07 Inventory of NIST Bioscience Investments

For this Inventory, **Biosciences** is defined as:

- The study of the cause of diseases, the development of therapeutics and the diagnosis and treatment of diseases

and

- The study of biological materials for food, energy, environment, forensics and biohazard detection

Inventory "Accounting" Process:

- The funds of each OU cost center were allocated among 13 "bins": 11 specified bioscience categories, an "other bio" category, and a "non-bio" category.
- For each project, the sum of the funds allocated into the 13 "bins" equaled the total funds in that project. I.e., there was no "double counting".

Major BioSciences Healthcare Industry Sectors

(March 07 VCAT)

- **Health Care**
  - Diagnostics
  - Drug Development
  - Medical Devices
  - Services
- **Biotechnology**
  - Energy
  - Food products
  - Materials
- **Life Science Research**
  - Instrumentation, devices, and reagents for research
- **Homeland Security**
  - Forensics
  - Biometrics
  - Biohazard detection

Categories for NIST FY07 Biosciences Inventory

- Diagnostics
- Drug Development
- Therapeutics
- Medical Devices
- Healthcare IT
- Energy
- Food Safety and Nutrition
- Biomaterials (including tissue engineering)
- Forensics
- Biometrics
- Biohazard detection
- **Other bio**
- ***Non-bio***

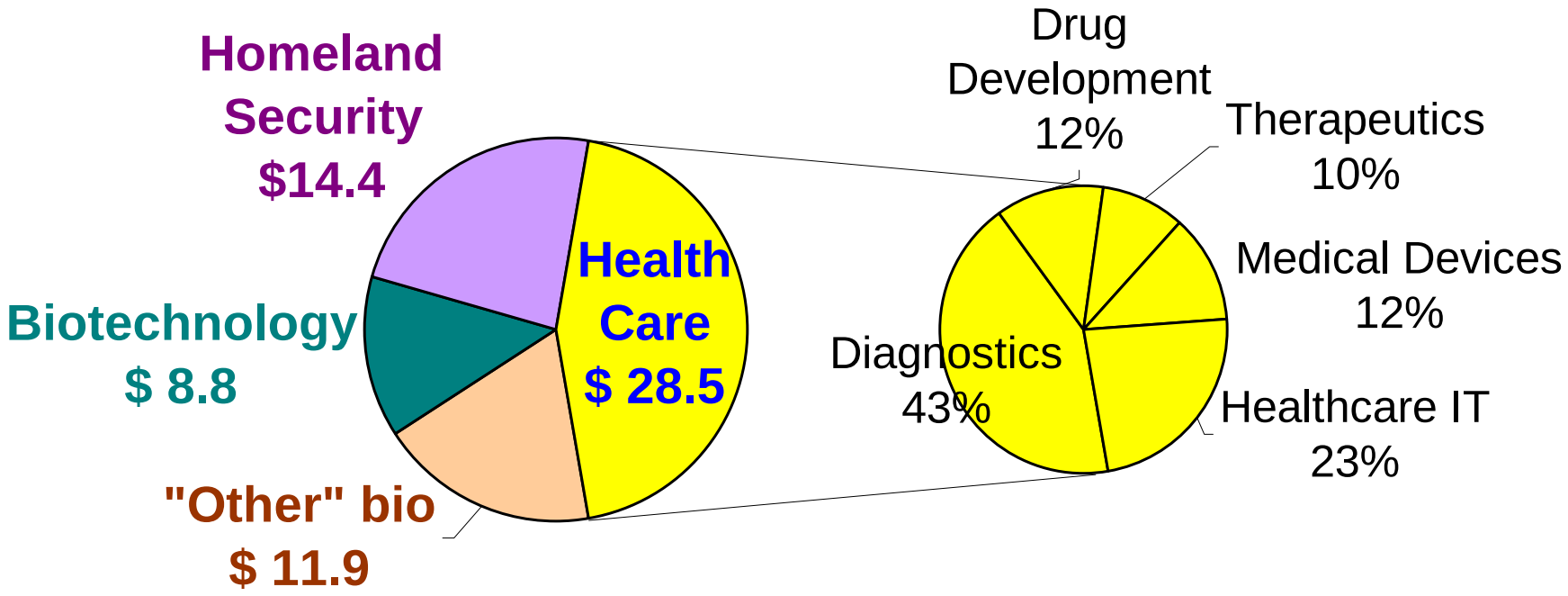
FY07 NIST Investment in the Biosciences -- $64M

Inventory of FY07 NIST OU Bioscience Investments from all sources* ($K)														
	Health Care (45%)					Biotechnology (14%)			Homeland Security (23%)			Other Bio (19%)		
By OU	Diagnostics	Drug Development	Therapeutics	Medical Devices	Healthcare IT	Energy	Food Safety and Nutrition	Biomaterials (including tissue engineering)	Forensics	Biometrics	Biohazard detection	Other bio	OU Bio Subtotal $K	Total OU funds $K
BFRL	0	0	0	0	0	0	0	0	0	0	0	287	*287*	40,887
CSTL	7,186	1,890	1,905	535	876	1,452	2,048	435	2,829	166	1,556	9,839	*30,719*	85,332
EEEL	1,142	140	0	621	173	0	0	49	102	0	190	417	*2,832*	51,783
ITL	715	312	0	537	5,274	0	0	135	0	8,890	120	18	*16,000*	93,372
MEL	0	0	0	573	368	0	0	97	0	0	0	271	*1,309*	49,008
MSEL	537	0	411	575	0	0	0	4,268	0	0	0	216	*6,007*	51,977
PL	2,564	1,150	409	607	0	0	150	154	12	0	915	896	*6,856*	88,128
Total	**12,145**	**3,491**	**2,726**	**3,448**	**6,691**	**1,452**	**2,198**	**5,137**	**2,943**	**9,055**	**2,780**	**11,944**	**64,009**	**460,487**
% NIST Base	**71%**	**82%**	**48%**	**75%**	**52%**	**58%**	**8%**	**74%**	**7%**	**26%**	**55%**	**80%**	**58%**	

14%

Includes: appropriated funds, funding from other agencies, reimbursable funds (from provision of Standard Reference Materials, Calibration and Reference Data services), etc.

NIST FY07 $ By Major BioSciences / Healthcare Industry Sectors



NIST FY07 Total for Bioscience = $ 64 M

- **Health Care**
  - Diagnostics
  - Drug Development
  - Medical Devices
  - Services
- **Biotechnology**
  - Energy
  - Food products
  - Materials
- **Life Science Research**
  - Instrumentation, devices,& reagents for research
- **Homeland Security**
  - Forensics
  - Biometrics
  - Biohazard detection

Health Care: $ 28.5 M

- Diagnostics
- Therapeutics
- Medical Devices
- Healthcare IT

Includes:

Diagnostics and Therapeutics

- Standards for Medical Imaging
- Metrology for Gene Expression
- Cellular Biometrology
- Standards for Clinical Diagnostics
- Measurements and Standards for Cancer Biomarker Discovery
- Measurements and Standards for Ionizing Radiation Applications
- Standards for Clinical Proteomics

Drug Development

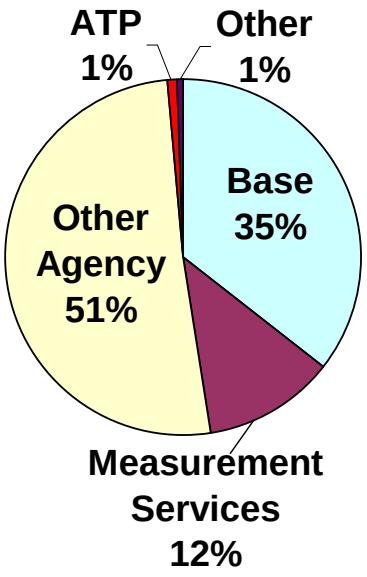
- Radioactivity Standards and Source Testing
- Ultrafast spectroscopy of proteins

Medical Devices

- Documentary and reference standards for reliability testing of active implantable medical devices and for reduction of uncertainty in bone densitometry.
- Growth and manipulation of nanowires for nanolaser medical applications
- Biological microfluidics;
- Dosimetry Calibration Service

Healthcare IT

- Prototype for cross-platform exchange, collection, retrieval of clinical documents
- Display metrology for medical interoperability



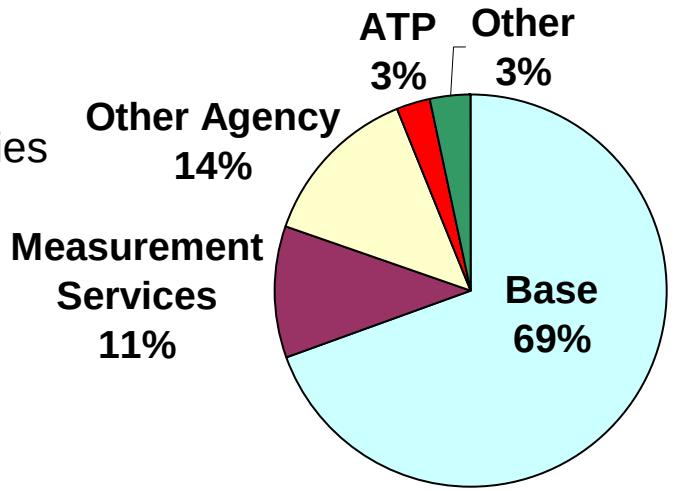
Biotechnology: $ 8.8 M

- Energy
- Food Safety & Nutrition
- Biomaterials

Includes:

Energy

- Biofuels: biocatalysis, fluid properties, combustion studies
- SRM/RM for critical parameters in biodiesel



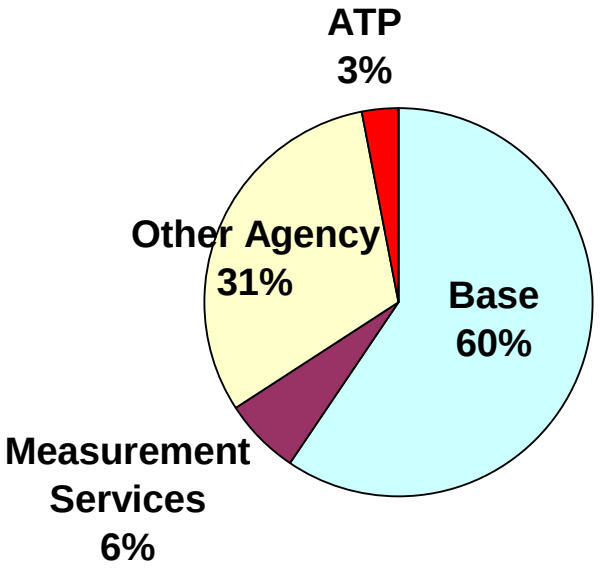
Food Safety & Nutrition

- Methods and Stds for nutrients in foods
- Methods and Stds for GMOs
- Methods and Stds to support safety, identification, and efficacy assessment of dietary supplements
- Fruit irradiation for preclearance requirements

- Characterization and Properties of Tissue Engineering materials
- Test platforms for cell and tissue mechanics; includes bioreactor design and BioMEMS fabrication for single cell testing
- Development, characterization, and performance properties of dental biomaterials
- Nanoparticles in Bio Tissues

Homeland Security: $ 14.8 M

- Forensics
- Biometrics
- Biohazard detection



Includes:

- DNA Based Human Identification
- Trace Drug Detection

- ITL Biometrics ($8.9 M)

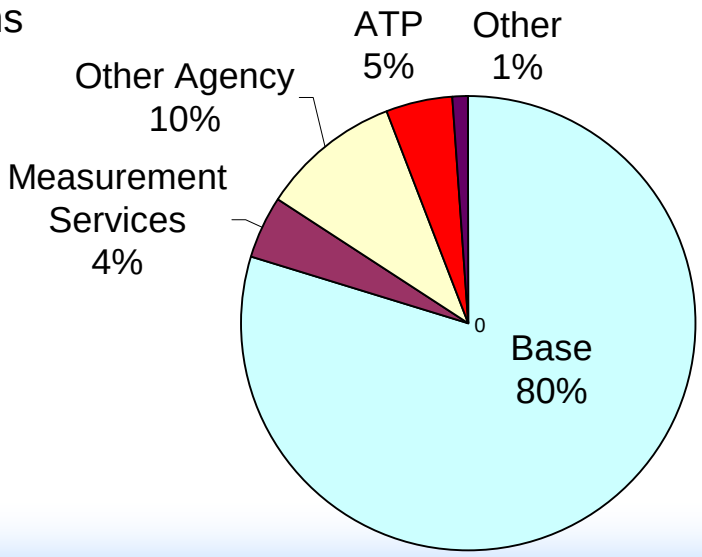
- Biohazard detection sensors
- Documentary standards for biohazard sample collection
- Positive control samples to support HLS biological analyses
- HLS microbial analyses and ID standards
- Evaluations of technologies for Water Decontamination in Buildings (EPA)

- *Portions of projects applicable to numerous bioscience categories*

“Other” bio: $ 11.9 M

Includes:

- Metrology for biological effects of electromagnetic radiation
- Electrical connections and control for single cells
- measurement methods and predictive tools for determining fate of nanoparticles in biosystems and properties influencing their complete cycle within biosystems
- airborne infections – control of airborne contaminants and Bio-based product testing - using BEES software to assess the life-cycle of products
- Health safety testing of security tech
- Vision science as a basis for optical
- bio microarray measurements
- Biosensors
- Spectroscopy standards - pharmaceutical applications
- QA for the “omics”
- Systems biology



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  - Metrology for Nano EHS [FY08 Initiative]
  - Actions to Strengthen and Leverage Existing and Establish New Partnerships
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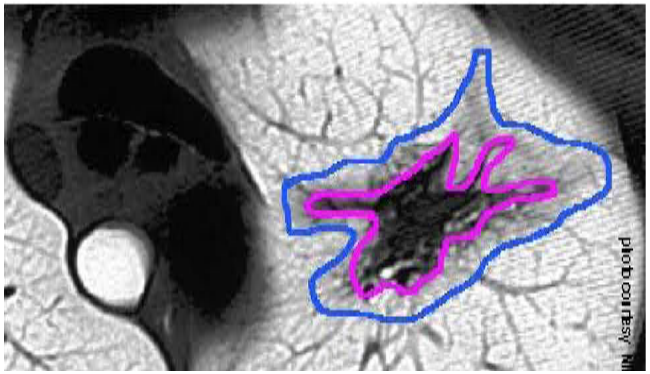
Bioimaging: A 21st Century Toolbox for Medical Technology

FY07: + $3 million; FY08: + $1M

Macroscopic imaging (MRI, CT, PET)

The problem with MRI and the exciting new imaging modality combination of PET/CT, is that radiologists and oncologists **must rely on visual comparisons** to determine if a tumor is shrinking and/or if medically-relevant topographical features have changed with treatment.



Microscopic Imaging (Fluorescence, quantum dots, label-free methods)

Pathologists and drug discovery scientists use fluorescent antibody and DNA probes, as well as various label-free spectroscopic imaging techniques to look at cells and tissues

but, **results are almost impossible to compare** from one lab to another.

Standards for Bioimaging Program

A. Quantitative Medical Imaging

EEEL and PL

NIST's work will enable digitization of the images to allow for accurate size quantitation and understanding of changes to topological features.

B. Quantitative Imaging of Cells and Tissues

CSTL and MSEL

NIST's work will develop ways to standardize these microscopic imaging modalities.

C. Standards and Validation for Software

ITL and MEL

NIST work will establish software validation methods that will enable more accurate, quantitative and comparable image feature measurement and detection

Examples of Year 1 Activities

- Metrology for MRI contrast agents over a broad range of field and frequency
- Establish MRI standards such as NIST-traceable T1, T2 relaxation time standards.
- 3D phantom models for CT/PET

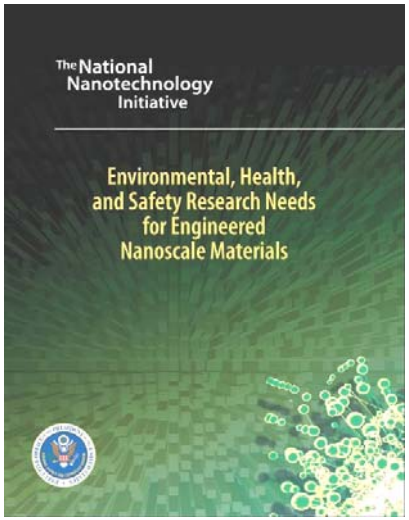
- First reference materials for intensity standardization of fluorescence microscopy
- Determine mass detection limits of broadband CARS

- Develop statistical methodology for annotating lung cancer CT images
- Develop standard methods and technologies for combining, interpreting, registration, and visualizing data from various imaging techniques for RIDER, LIDC, and other related image data sets

Metrology for Assessing Environment, Health, and Safety Effects of Engineered Nanomaterials

What is the problem?

- **Health and environmental risks of nanomaterials, both actual and perceived, are roadblocks for innovation and commercialization of nanotechnology.**
  - Data quality inhibits the ability to understand, predict, and manage potential risks of engineered nanoscale materials.
  - Lack of certainty in nanoscale measurements impacts regulatory and policy decisions.



What is NIST's solution to this problem?

- **Develop a national-scale nano-metrology infrastructure that enables science-based decision-making**
- **Unify government and industry nano-metrology efforts to manage nanomaterial EHS risks**

Why should NIST be the one doing this?

- **Measurements are critical to assess nano EHS**
- **Identified by the NNI* as the lead agency on nanoscale metrology**

***The National Nanotechnology Initiative (NNI) is a federal R&D program established to coordinate the multiagency efforts in nanoscale science, engineering, and technology.**

Programmatic Outline of the Initiative
Metrology and Tools to Support Nanomaterial EHS

Theme	Year 1	Year 1 and Outyears	Outyears
Classification System	Establish unifying definitions for classes of nanomaterials	Initiate national effort to develop standards	Deliver standard - reference materials - reference data - interlaboratory comparisons
Characterization Methods and Instrumentation	Identify and critically evaluate existing nanoscale methods and devices	Develop new and extend existing methods to meet measurement challenges	Deliver validated - instrumentation - measurement methods - protocols
Validation of Toxicological Measurements	Facilitate the assessment of state of the art toxicological measurements	Integrate classification scheme into toxicological assessment	Create and disseminate reference materials and protocols for nanomaterial toxicology

The NNI expects NIST to lead efforts to develop tools necessary for assessing EHS of nanomaterials.

"Standards for Environmental, Health, and Safety Research Needs for Engineered Nanoscale Materials"

September 12-13, 2007 Workshop hosted by NIST

Purpose: To identify standard materials needed to address toxicology and risk assessments of engineered nanoscale materials and technical challenges that inhibit nanomaterial risk management decision making processes and progress for the regulatory community and industry

Audience: representatives from the NNI agencies and departments, program managers, manufacturers, toxicologists, risk assessors, and standard developers (Invitation-only with maximum of 60 participants)

Goals:

1. Develop approaches for identifying standard materials critical for toxicology and risk assessment
2. Nomination of materials specific to user and community needs
3. Identify critical materials characterization parameters required to meet needs of specific users and communities
4. Identify priority reference materials, characterizations and time-scales for development

Methods to Support Toxicology Measurements for Nano EHS

- Promote better understanding of toxicological studies performed on cells *in vitro* by providing (1) improved imaging capabilities, and (2) advanced, high-throughput measurement techniques and technologies.
  - Use of advanced microscopy methods
  - Use of advanced imaging methods; results may be used to improve predictive models
  - Determination of molecular and atomic scale interactions that result in a toxicological response
  - Development of high-throughput microfluidic cellular toxicity assays
  - Development of approaches for tissue culture assays
- Investigate correlations between cell-based and animal study results

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  - Metrology for Nano EHS [FY08 Initiative]
  - **Actions to Strengthen and Leverage Existing and Establish New Partnerships**
- Future Plans for Program Expansion

Center for Advanced Research in Biotechnology (CARB)

- **In 1985, NIST's CSTL and the University of Maryland joined with Montgomery County, MD to establish the Center for Advanced Research in Biotechnology (CARB), a joint research venture emphasizing work on the relationship between structure and function in biomolecules and the development of new technologies for the measurement, analysis and design of biomolecules.**

- **CARB cultivates a research environment that will also foster the advancement of the local and national biotechnology industry.**

CARB conducts research and provides interdisciplinary training in fundamental problems at the forefront of biotechnology.

http://www.umbi.umd.edu/centers/carb.html

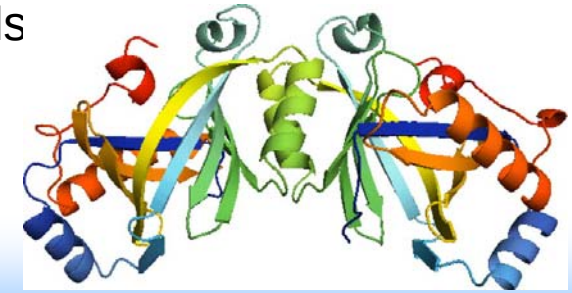
NIST and University of Maryland

CSTL/CARB Program Activities

Over the years, ~10 to 12 NIST staff in the **Structural Biology** Group of CSTL's Biochemical Science Division were/are physically located at CARB.

Current activities include:

- Methods to obtain 3-D structures of proteins and DNA
- Tools to determine the dynamics of proteins, nucleic acids, and protein-nucleic acids complexes in solution
- Study of macromolecular structure, interactions and function
  - Studies include understanding the role of RNA/DNA structures and interactions in plasmid copy number regulation and retroviral replication
- Study of mutation and evolutionary genomics
  - Studies include understanding how biases in mutation bias the course of evolution
- Improved bioinformatics tools



NIST National Institute of Standards and Technology

CARB Center for Advanced Research in Biotechnology

While reasonably productive, it has been apparent to most that the collaborative model initiated in 1985 has not fully leveraged the strengths of both organizations:

- CARB talent and capabilities have been somewhat isolated and not benefited fully from NIST capabilities and strengths
- NIST has not fully tapped into and benefited from the excellent and rapidly expanding capabilities at CARB

A new model was needed

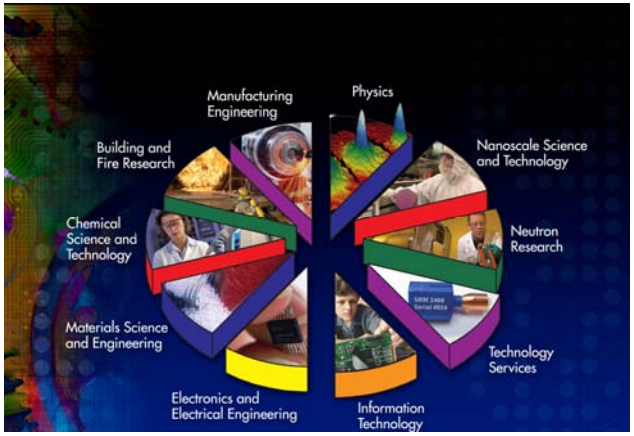
Actions to Strengthen and Leverage the Partnership

New MOU signed in August 2007

- ***Partnership expanded to include:***
  - ***all five UMBI Centers, not solely CARB***
    - Center for Advanced Research in Biotechnology
    - Center for Biosystems Research
    - COMB Center of Marine Biotechnology
    - Institute of Human Virology
    - Medical Biotechnology Center

UMBI President, Dr. Jennie Hunter-Cevera, signs agreement expanding joint research and educational activities with NIST Director, Dr. William Jeffrey.

  - ***all nine NIST research laboratories***
    - New Joint PL/CARB Institute planned
    - CSTL planning new activities with CBR and COMB



- ***NIST is a fully engaged partner and participates in strategic directions and decision-making regarding collaborative research***

Actions to Strengthen and Leverage Partnership

New MOU

- *Provides for:*
  - ***interdisciplinary research programs*** *that*
    - ***leverage NIST's measurement and analysis expertise across the range of physical sciences with UMBI's resources;***
    - ***broaden access to the specialized research facilities of both institutions;***
  - ***increased exchange of staff*** *though temporary appointments;*
  - ***training programs for students that capitalize on the unique expertise and facilities*** *at both institutions*

NIST and UMBI are jointly sponsoring International Symposium in October 2008:

"Measurement and Standards Barriers to Innovation in the Biosciences"

Specialized Research Facilities/Capabilities

UMBI
University of Maryland Biotechnology Institute

- CARB Core Facilities
  - GMP Biomanufacturing Program Microarray Core Facility
  - NMR and X-ray Crystallography Facilities
- CBR
  - DNA Sequencing Facility
  - Plant and Insect Transformation Facilities
  - DNA microarray production and analysis core facility
- COMB
  - Fermentation Facilities
  - Aquaculture / Fisheries Research Facility
- MBC
  - Biosafety Level 3 laboratory suite
  - animal core faciliity
- IHV
  - Animal study facilities
  - Vaccine Development
  - Clinical Research/Trials

NIST
National Institute of Standards and Technology

- NIST Center for Neutron Research
- Center for Nanoscale Science and Technology
- Advanced Chemical Sciences Laboratory
- Advanced Measurement Laboratories
- Specimen Banking Facilities and Technology
- High Field NMR Facilities at HML
- Statistical Engineering Support
- Combinatorial Methods Center

Hollings Marine Laboratory

Partners: **NOAA, NIST, SC Dept. of Natural Resources, Univ. of Charleston, Medical Univ. of SC**

- established in 1995 in Charleston, SC as the Marine Environmental Health Research Laboratory (MEHRL)
- Initially housed in existing NOAA space, the new 78,000 square foot state-of-the-art research facility was completed in Feb 2002
- 25 NIST staff

Multidisciplinary teams of scientists from the chemical, biological, environmental, and biomedical fields perform cutting-edge research focusing on understand linkages between environmental condition and the health of marine organisms and humans

Programs include:

- **Environmental/Analytical Chemistry**
- **Cryogenic Storage**
- **Environmental Biology/Response Evaluation**
- **Molecular Biology and Physiology**
- **Aquatic Production**

Actions to Strengthen and Leverage Existing Partnership between NIST and Hollings Marine Laboratory

Full utilization of unique expertise, equipment and facilities

- New NMR Program Established

Measurements and standards to support innovation in marine biosciences

- Aquaculture
  - Sponsorship of workshop “Measurement and Standards Barriers to Innovation in U.S. Aquaculture” as part of the “Aqua America 2008 Conference” in February 2008
- Baseline data for assessing Marine Mammal Health
  - Assessment of how gross phenotypic characteristics of cells correlate with their gene expression in response to environmental conditions

NMR Facility at Hollings Marine Lab

- 800 MHz standard-bore system and shielded 700 MHz standard-bore system

- Both instruments have:
  - TCI-triple resonance, single gradient cryoprobes
  - 5mm room temperature triple-resonance, triple gradient probes
  - 1 mm room temperature triple resonance, single gradient probes

- In addition, the 700 MHz instrument has:
  - High-resolution Magic Angle Spinning (HR-MAS) probe
  - HPLC/MS/NMR accessory

Current and planned activities/applications

metabolomics, human disease biomarker discovery, medical screening, biotoxin research, natural products discovery, micro-imaging, environmental toxicology, etc.

New Strategic Partnerships and Interactions

- University of Alabama at Birmingham (UAB)

- Institute for Systems Biology (ISB)

- Food and Drug Administration (FDA)

Interactions with the Institute for Systems Biology

Three meetings over the past year to:

- Lean more about
  - ISB and Systems Biology
  - “P4” Medicine and associated technology and standards needs
- Discuss areas of potential collaboration based on complimentary interests, competencies and skill sets
  - Proteomics
  - Cell-based Measurements
  - IT Standardization

New Collaborative Program Initiated

"Biocomputing for single cell analysis"

Goal: To determine a necessary infrastructure that would enable interoperability of experimental cell imaging data collected in different laboratories, and to test the interoperability of data by comparing the results of experiments conducted at NIST and ISB.

Approach: This infrastructure will require the development and application of appropriate physical and software standards and validation protocols at all stages of the experiment.

These stages include:

- Establishing experimental conditions and parameters
- Data acquisition
- Image pre-processing
- Data and metadata storage
- Image Analysis
- Interpretation of image data
- Software integration

Initiating High-level Strategic Relationship between NIST and FDA Leadership

- Initial meeting July 2007 with the FDA Deputy Commissioner and FDA's Critical Path Steering Committee

- Next Steps:
  - Inventory of current staff-level interactions between NIST and FDA
  - Meeting at NIST between FDA and NIST Senior Leadership
    - to facilitate a better understanding of FDA measurement, standards and technology needs,
    - to acquaint FDA with NIST's areas of expertise and capabilities
    - to begin establishing a more strategic alignment of NIST and FDA collaborations and interactions

Outline for This Presentation

- NIST Role in Biosciences and Health
- Summary of our Current Investments and Activities
- Update on Implementation of our Strategic Vision for Bioscience and Health Activities
- **Future Plans for Program Expansion**

Charge from VCAT Subcommittee for Bioscience and Health March 2007

- Characterize industry segments and identify
- FOCUS, FOCUS, FOCUS
- Know where you want to make a contribution and prioritize your choices
- It takes a lot of money/resources to succeed in addressing the most critical measurement issues in Bioscience
- Dare to be “great”. Think big, think BOLD
- Assemble an organization that leverages the resources
- Set a goal to “be the recognized leader” for measurements and standards in your chosen segments of the industry… and make it a passion

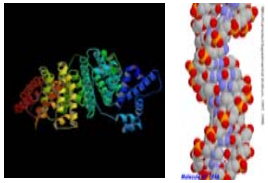
Metrology for Understanding Complex Biological Systems

- **What is the opportunity?** Tremendous Federal and industry investment in the biosciences has dramatically increased our understanding of living systems However, concurrent advances in measurement capabilities needed to exploit this explosion of knowledge have not occurred.
  - The majority of bioscience measurements are not highly quantitative
  - Current bioscience measurement tools and methods produce highly variable results
  - Ability does not exist to simultaneously measure the 1000s of biomolecules involved in processes occurring at the cellular level
  - Bioinformatics has no established standards to enable the prediction of changes over time

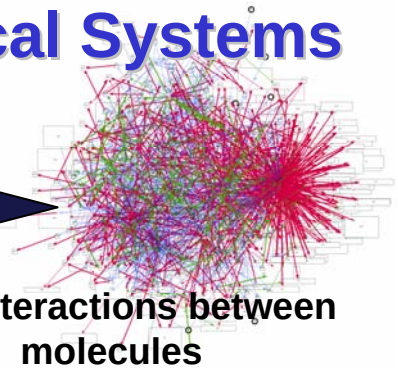
- **What is NIST's proposed solution to this problem?**
  - Provide the measurement tools and standards that enable
    - Quantifiable and reproducible measurements of biological molecules
    - Simultaneous measurements of high numbers of heterogeneous biological molecules
    - Accurate dynamic observations and comparisons of the relationships between multiple biological networks

- **Why should NIST be the one doing this?**
  - Provision of these measurement tools requires a combination of complex physical measurement and information science expertise that lies outside the life sciences community

Metrology for Understanding Complex Biological Systems



Increasing Levels Of Complexity



Single classes of … molecules	…Simultaneous measurements … of multiple classes	… Interactions between molecules
NEAR		
Quantitative Measurements	***High Volume Measurement Platforms***	***Dynamic Systems Level Measurements***
• Standards and methods to enhance accuracy of current technologies • Standards for measurements in complex protein matrices	• Increase reliability and functionality of microfluidic devices • Improve quantitation of image-based biomarkers – subcellular, cellular and tissue levels	• Analysis methods to permit comparability of image data among labs • Assuring interoperability of databases and software
MID-TERM		
• Improve resolution and accuracy of cell measurements • Methods for characterizing affinity reagents	• New platforms capable of multiplexed measurements on large numbers of samples • Methods for characterizing uncertainty from multiplexed measurements	• Methods for characterizing uncertainty between disparate datasets • Benchmarks for *in silico* model validation
LONG RANGE		
	• Computational methods for deconvoluting complex data • New technologies to quantify cellular biochemical events in real time	

NIST and UMBI are jointly sponsoring International Symposium in October 2008

"Measurement, Standards and Technology Barriers to Innovation in the Biosciences

Expected outcome:

Identification and prioritization of measurement and standards barriers to innovation and the achievement of maximal societal and economic benefits from advancements of our knowledge in the biosciences

Format:

- Full day of Symposium focused on bioscience-related areas with great potential for economic and overall societal benefit
- 3-day Workshop to flesh out measurement and standards challenges that represent significant barriers to innovation in selected focus areas

Participants:

International experts from industry, academia and government

NIST Role in the Biosciences

To leverage our vast expertise in the **quantitative physical and informational sciences** to provide the measurement infrastructure to underpin increased **innovation in the biosciences.**

We do this by

- ***Maintaining World-Class research programs and facilities for the physical, chemical and informational sciences***
- ***Recruiting staff with expertise and interest in working as part of interdisciplinary teams***
- ***Establishing new and strengthening existing external partnerships that complement our facilities and expertise***
- ***Working with stakeholders in the government, academic and private sectors to identify and address measurement and information barriers to innovation***